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ABSTRACT

This conceptual expression of "task interdependence," or role coupling, derived from research of elementary teachers in self-contained schools and team teaching schools, recommends that organizational theory provide clear concepts and measures to capture significant variations among schools. Research, measuring the independence-interdependence variable before and after team teaching implementation, sought a high degree of task interdependence. Autonomous personnel in a loosely coupled system were reorganized into collaborative work groups in a tightly coupled system. Researchers identified three types of task interdependence among teaching pairs: (1) resource interdependence--drawing on scarce resources; (2) throughput interdependence--depending upon another teacher to release pupils before the teacher can proceed; and (3) instructional interdependence--pursuing the same instructional activities and pupils. Instructional interdependence was measured because its intensity presupposedly increases with frequency of events, which imposes contingencies. Base information was obtained from daily teacher records of pupils and subjects taught. Observations indicate a loose coupling in the work system of team teaching schools; instructional interdependence is rare. Such characterizations of conventional schools as teacher isolation are over-drawn, for researchers found varying departures. Ironically, in contrasting conventional schools with team teaching schools, researchers discovered that what informants described was not, after measurement, so conventional. Stereotypes of the school's work system require replacement with useful categories by careful description and measurement. (CJH)

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ROLE COUPLING IN THE SCHOOL'S WORK SYSTEM: OPERATIONALIZING TASK INTERDEPENDENCE AMONG TEACHING PERSONNEL

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Working Paper Prepared for Meeting of Task Group
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When our chairman contacted me about preparing a working paper for the meeting of our group, I demurred at first on grounds that I could not afford diversion from obligations to the research project at the University of Oregon that pays two-thirds of my salary. Eventually I agreed, on condition that the paper would be closely associated with the writing I had to do anyhow in connection with the project. The chairman accepted this as a tolerable condition.

The fact is, our research deals in part with role coupling among teaching personnel in the elementary school. We happen to call it "task interdependence." We are studying what happens to the distrubution of power (among other things) when an innovation is introduced into the school that markedly increases the task interdependence among teachers. We are using a "before-after with control group" design, with team teaching as the treatment variable. Team teaching involves forming otherwise autonomous, isolated instructional personnel into closely-knit, collaborative work groups for carrying out the core "productive" activities of the school. As we see it, the essence of team teaching is the replacement of a loosely coupled role system among the organization's primary workers with a tightly coupled system. Our research project requires that we measure the independence-interdependence variable. We need to establish that a high degree of task interdependence indeed intervened between our "before" and "after" measures on power distributions and other consequences; we need to establish that interdependence was not already high before the "before" measures.

Thus, our project has taken us deeply into an analysis of the school's work system (technology, as some like to call it) and into a consideration, in particular, of the manner in which primary workers--i.e., teachers--are and are not linked together by way of the workflow. Much of the discussion of the school's technology, like that of other people-serving organizations, emphasizes the fundamental uncertainty of the technical processes of work. Particular means of instruction do not connect unequivocally with outcomes for learning, either in the short run or the long run. This we take for granted. But we find it a universal condition of educational institutions, hence not especially useful as an analytical tool for distinguishing among educational institutions. If organization theory is to make a contribution to educational affairs, it must provide fine-grained concepts and measures capturing significant variations from one school to the next, not just concepts that contrast schools with automobile assembly plants. The idea of task interdependence among teaching personnel appears to serve this finely differentiating purpose.

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This is not a position paper proposing a variety of ideas regarding how the school can be studied as a loosely coupled organization--nor even one idea. Rather, it is a report on the efforts of my colleagues and myself to give empirical expression to the concept of task interdependence. We have distinguished three types of interdependence and have developed procedures for attaching a metric to one of them--the one most relevant to the project requirement of measuring the existence of team teaching. My excuse for writing such a paper is that eventually researchers will have to bring the notion of coupling (loose or otherwise) down closer to earth, and this we have attempted to do. In the process, we have gained some clarity regarding the meaning of the term as it applies to schools, and it may be useful to share it.

The Concept of Task Interdependence

Our thanks go to Weick (1965) for his cogent treatment of task interdependence and related concepts in his chapter of the March Handbook of Organizations. Among other things, he made us realize that interdependence inheres in the way work is laid out and in the way component activities must, or do, come together to achieve a result. Analytically speaking, the arrangement of work activities and the kind of interdependence it implies pre-dates task performance itself. The arrangement can be examined in its own right. As Weick emphasized, task interdependence denotes a relationship between persons that arises specifically by virtue of work activities and in this way is different from relationships due to group membership, power, status, and other social forms. He defined it as the circumstance in which "the task performance of one person constrains or augments the performance of another" (p. 222).

As we reflected on the meaning of the term for the work of the school, we recognized that task interdependence is relative to the time frame within which it is discussed. Some years ago, in analyzing the organization of tasks in the school, I had found it necessary, or at least fruitful, to build the analysis around the flow of events through time (Charters, 1964). The school is an enterprize in which a vast number of events are arranged for pupils that are intended in a cumulative fashion to have lasting effects on the pupils' cognitive capacities and behavioral propensities. Instruction is the process of ordering these events in a hopefully effective way and inducing pupil exposure to them. The slippage between exposure and outcome, of course, is enormous. Nevertheless, instructional personnel and those responsible for the school's curriculum act on the presumption that the means are more than randomly associated with the ends and go on about the business of planning assignments and lessons, units of study, courses, sets of courses forming a curricular program, and so on. The logic for ordering events is not strictly incremental, like one element leading to the next, which leads to the next, which leads to the next in a linear and narrowly cumulative manner. Rather, the logic is more in the way of embeddedness: particular learning activities during a class period are presumed to contribute in aggregate to the objectives of the lesson in which they are embedded, and a sequence of lessons is expected to contribute to, and gain their meaning from, the objectives of the unit of study. A striking thing about the school is the hierarchical levels according to which tasks are found to be organized, each extending further in time and subsuming the level below it.

The upshot of this is that if one defines the school's tasks at one level of organization, he is likely to see connections among them and among those who perform them that disappear when tasks are defined from a shorter run, more microscopic perspective. Concretely, a second- and third-grade teacher in a given school might be seen as working highly autonomously and with only a minimum of task interdependence when viewed within the same time frame of an academic year; the task performance of one teacher would pose few contingencies for the performance of the other. But if the time frame were extended to encompass several years, a different estimate of their interdependence might well emerge; what the second-grade teacher did or did not do in teaching her pupils might have an important impact on the task performance of the next teacher responsible for teaching the same pupils.

Thus, we found it essential to specify the time frame within which we would measure interdependence. The requirements of our study--specifically, the nature of the innovation under investigation--dictated the answer. Team teaching represents a coupling of teachers in the immediate, intimate aspects of their work. Change along the independence-interdependence dimension should be apparent at a reasonably microscopic level of task definition in the event that team teaching gets established in the school. Correspondingly, we adopted the academic year as the unit within which to conceptualize and express task interdependence among instructional personnel. There is no question in our minds that a more extended frame would bring into view an array of important questions regarding interdependence and the coordination processes inexorably associated with it--perhaps more significant for organizational analysis than the ones with which we are dealing--but their consideration must wait for another time and place.

Types of Task Interdependence

Discussions of task interdependence in the literature focus mainly on distinguishing types, and although we intended eventually to go beyond that to measure degrees of task interdependence, our project staff thought a good bit about the proposed typologies and how they might be represented in the school's work system. We found it difficult to make an exact translation of any one of the typologies, at least in a way that would faithfully capture the kinds of work connections likely to arise among teachers within the time frame we had adopted. Weick (1965) talked about "disjunctive," "conjunctive," and "cumulative" interdependence, drawing on the writings of Thibaut and Kelley, but these types refer to various ways actions must combine to produce an outcome--unequivocal task accomplishment--and instructional work simply does not have unambiguous means-ends connections.

Nor could we make a fruitful application of the "pooled," "sequential," and "reciprocal" types of interdependence suggested by Thompson (1967) within the academic year time unit to which we had subscribed. We have been strongly influenced, however, by Thompson's general ideas regarding the intimate association between types of interdependence and the kinds of mechanisms required for the coordination of work. As you will recall, Thompson parallelled his three types of interdependence with the mechanisms of coordination by "standardization," by "plan," and by "mutual adjustment." The last one has come to play a prominent part in our thinking about degrees of interdependence.

We ended up developing a typology of our own. Concentrating as concretely as we could on the work of teaching (within our one-year time frame) we asked ourselves the question, what are the ways in which the task performance of one teacher poses contingencies for the performance of another? What might one teacher do, or fail to do, in the pursuit of his direct instructional responsibilities that would have a clear effect on another teacher's pursuit of his classroom responsibilities if some coordinating mechanism were not in place? By answering the question, we identified three types of task interdependence. It is worth noting that the types apply to any given pair of teachers in the school, not to teachers as a whole. We wanted to retain the capability of differentiating among members of the school's instructional staff in terms of the extent of their interdependence.

Resource interdependence refers to circumstances in which Teachers A and B draw commonly on scarce resources required by each in pursuit of his instructional responsibilities. The scarce resources may be durable, like teaching space, equipment, reference materials, or the service of specialists or aides, or consumable, like instructional supplies, workbooks, or discretionary funds.

Throughput interdependence refers to the circumstances in which A or B cannot proceed with his separate instructional activities until the pupils he is to teach (the "throughput units") are released by the other teacher.

Instructional interdependence concerns the circumstance in which A and B are pursuing the same instructional activities with respect to the same pupils, either simultaneously in one classroom or according to some alternating, periodic arrangement.

The types are not mutually exclusive. They are ordered as in a cumulative scale, in the same way Thompson conceived his typology. Instructional interdependence implies both throughput and resource interdependence; throughput interdependence implies resource interdependence but not instructional interdependence; and resource interdependence implies neither of the other two.

The mechanisms for coordinating action where resource interdependence pertains are mainly usage schedules (for durable resources) and quotas (in the case of consumable resources). Coordination of throughput interdependence is achieved by class schedules, often accompanied by audible signals. Instructional interdependence requires coordination processes of a considerably less mechanistic sort, entailing some form of communication (discussions, immediate and informal interchanges, even the passing of non-verbal signs) directly between those engaged in task performance. It is like Thompson's notion of mutual adjustment, although we do not insist, in the interpersonal situation we are visualizing, that adjustment be mutual; graduate teaching fellows may adjust their activities in their discussion sections to the professor's lecture and not vice versa.

All teachers in a school in a particular year are bound together by resource interdependence, albeit in varying degrees of connection. (While we have not tried to develop a metric for resource interdependence, nor for throughput interdependence, for that matter, it seems apparent that pairs of teachers differ substantially in terms of the demands they make on similar resources;

two sixth-grade teachers, for example, are more likely to lay claim on the school's curriculum packages in science than are a sixth-grade and first-grade teacher.) With respect to throughput and instructional interdependence, however, only those teachers who share in a particular pupilflow are bound together. The basic question is whether two teachers do or do not teach at least some of the same pupils in common. If they do not have pupils in common--do not share in the pupilflow--definitionally they can have neither throughput nor instructional interdependence. It is here, especially, that we must take care to specify the time frame at stake, since a first-grade and sixth-grade teacher might be seen as teaching the same pupils if one's perspective were sufficiently extended.

A word is in order regarding the concept of pupilflow. Pupilflows (and the teachers they implicate) are readily traceable in educational institutions if care is taken to assemble the appropriate information. Moreover, important differences appear in pupilflow patterns and the way they connect teachers from one institution to the next. Differences are associated with significant educational practices: differing staffing plans, modes of dividing labor, curricular programs, and so on. A program for physically handicapped children, for instance, may be set up so that the children are removed periodically from their regular classrooms for special training or tutoring, then returned to the regular classroom for the bulk of their instruction. On the other hand, the program may operate essentially as a separate school within the school with an entirely distinct pupilflow. Under this circumstance, specialist teachers would have no throughput interdependence with members of the regular staff, and the attendant problems requiring coordination would not exist. Like the concept of workflow from which it derives, pupilflow is a useful analytical tool for examining the school's work system.

Throughput vs. Instructional Interdependence

The distinction we have drawn between throughput interdependence and instructional interdependence hinges on whether or not a teacher pair pursues the "same" instructional activities with their common pupils. Operationally, this turns out to mean whether they teach the same or different subjects to the pupils. Or, looking at it from the pupil's view, the question is whether he has one or two teachers for, say, language arts. Besides language arts, the subject areas include such categories as math, science, social studies, and so on. If two teachers teach the same subject to the same pupils, we identify it as an instance of instructional interdependence; if the subjects are different, it is throughput interdependence only.

We are not altogether happy with this operationalization, but our reasoning for employing it goes like this. The organization of teaching activities within a particular subject area tends to follow a logic of its own, including distinctive paraphernalia (textbook series), kinds of instructional activities (demonstrations in science but not in social studies), patterns of teacher-student interaction (class discussions in social studies but not in reading), types of objectives (appreciative objectives in art but not prominently so in arithmetic), sources of technical knowledge available to the teacher, and the like. An individual teacher teaching several subjects to the same pupils, as in the elementary classroom, are inclined to compartmentalize instruction by subject. Each subject

tends to follow a course of its own from one day to the next, relatively unaffected by the events of instruction in the other subjects in the intervening periods. To the extent this is true for the individual teacher, so it is true for two teachers teaching different subjects; they pose few contingencies for one another's task performance.

On the other hand, two teachers teaching a subject jointly are more likely to do things that noticeably affect how the other proceeds. Suppose, for example, that one science teacher prepares discussion materials to be used with a class following a film-and-lecture presentation on "tidewater ecology" by his partner teacher, but suppose, unbeknownst to the first that the partner has decided to show a film on the "history of the bubonic plague." The contingency is obvious; clearly the first teacher would be disaccommodated in his planning for the discussion session.

Our operationalization will not represent as instructional interdependence the contingencies arising between teachers who "correlate" their two subjects--such as social studies and language arts, or music and mathematics. Also, we are restricted to conventional categories of subjects, and we would run into trouble in schools where entirely different categories, or none at all, were used. The procedure, however, does not appear to do undue violence to the bulk of educational practices in the elementary schools in our study.

Degree of Instructional Interdependence.

The fundamental assumption of our procedure for assigning a metric to instructional interdependence is that the intensity of interdependence is a direct function of the frequency of the events that are likely to impose contingencies and thereby demand coordination. As we have noted, instructional interdependence ordinarily requires communication directly between the parties involved in task performance, so another more colloquial way of stating the assumption is that the more often teachers work together, the more they have to talk about what they are going to do or what they have done in order to avoid working at cross-purposes and to keep from getting in each other's way.

The concept rate of pupil exchange takes us a step further down the road toward an operational definition. We assume that the rate at which pupils move back and forth between two teachers for instruction in the same subject, the more each teacher has to take account of what the other is doing with the class and, by definition, the greater their instructional interdependence.

The Base Data

The base information from which we calculate the intensity of instructional interdependence is obtained in a straight-forward way. We simply ask each teacher in a school to keep a daily record of the pupils he teaches and the subjects he teaches them for ten consecutive school days. (We regard the two-week period as a time sample of the academic year.) To streamline the procedure for our respondents, we provide them with something like an attendance booklet--one page for each subject they might teach during the interval, and down the left side a list of the pupils who might be in their classes. In practice, the pupil list

is a sample of the school's total enrollment. The teacher needs only to log the subjects and pupils he does teach during each day. Since we are not interested in tracking individual pupils or fortuitous deviations from the prevailing pattern, often the teacher can make out his log in advance. This will be true in schools with simple or highly regularized forms of instructional organization.

Once the logs have been completed and returned to us, we can re-assemble them to reveal the pupilflows, if any, connecting various sets of teachers. There are several useful ways of re-assembling the teacher X pupil X subject X day information in the set of logs, but eventually we construct a large teacher-by-teacher matrix, entering for every pair of teachers an indication of whether or not they teach the same pupils and, if so, whether or not they teach them in the same subject. The latter instances are then singled out for measuring the intensity of instructional interdependence between them.

Thus, the initial data not only provide the base for calculating a numerical value for instructional interdependence but also display over-all patterns of instructional organization in the schools. We can derive from them, for example, charts indicating the extent of teacher specialization: the number of teachers who teach only one subject, two subjects, and on up to all subjects. The base data have turned out to be extraordinarily revealing of how the instructional program is organized in our subject schools.

The Intensity Measure

Having identified a pair of teachers with instructional interdependence in a subject, say math, we place their daily math logs side by side and note the frequency with which pupils move from one teacher to the other for instruction. Every exchange of pupils during the ten-day period counts as a one-unit increment in intensity of instructional interdependence. Thus, if Teacher A takes the math class all one week and Teacher B takes it all the next week, there is but one instance of pupil exchange, whereas if A and B teach on alternate days, they exchange pupils nine times. A special rule applies to instances of the teachers teaching math on the same day, a rule assigning it extra value. The most intimate and demanding sort of interdependence occurs when teachers work together jointly in the same classroom. While our procedure is not fine enough to tell us whether teachers teaching math on the same day are also teaching it in the same period of the day, it is at least possible that this most intensive form of instructional interdependence is occurring, and our weighting procedure acknowledges the possibility.

Following the counting rules, we reach a number expressing the intensity of instructional interdependence for a teacher-pair with respect to a given subject. Should the pair be linked by other subjects as well, intensity values are summed over the subjects. It is obvious that, by virtue of our pair-wise expression of intensity, that values can be aggregated for various subsets of teachers in a school, such as all primary teachers or all teachers at a particular grade level, or for the set as a whole.

Some Observations on the Data

It is not the purpose of this paper to report results of our study, nor am I able to, since we are still working the bugs out of our analysis procedures. But two general observations about our 40 schools are relevant in the present context.

First, role coupling in the work system of these schools does, indeed, seem to be loose. It is rather uncommon for us to encounter instances of instructional interdependence, even though I suspect our sample is biased in favor of finding them. When we do run across them, they tend to appear as isolated events involving a pair of teachers here, a trio there. It would seem that team teaching (as defined by our operations) is a voluntary arrangement entered into by teachers who find one another congenial to work with rather than a systematic organizational plan characterizing an entire school. The test of this supposition, though, is yet to come. The next rounds of data in our logitudinal study will reflect conditions after the schools have made a commitment to adopt teaching teams as a matter of institutional policy.

Second, and in spite of the foregoing, our base data indicate that the instructional organization of the elementary schools in our study is a good bit more intricate than we would be led to believe by the proponents of team teaching and similar staffing innovations. It is standard practice in the writings of the reform-minded promoters to contrast the virtues of their innovation with shortfalls of the "traditional" school. In making the case, they depict the conventional school as organized into "self-contained classrooms" where each teacher works in isolation from his fellows, teaching only "his" class of pupils throughout the year and covering all the subjects in the curriculum. The division of labor is described as primitive, specialization is said to be nil. Unfortunately, the proponents of staffing innovations are just about the only analysts of the school's work system there are, and it is easy to believe that most elementary schools are in fact the way they depict them.

Our data suggest that this characterization is over-drawn, even a caricature, of the conventional elementary school of the 1970s. True, we found a few among our 40 that correspond to the pure type of self-contained-classroom organization, but the large majority did not. They departed from the pure case in a profusion of ways, some only minor variations but others strikingly large. The language available to us from educational analysts is incapable of capturing the variations in form and gives little help in distinguishing variations that are significant from those that are trivial. It is interesting to note that, in selecting schools for our study, we tried to obtain a sample of conventional schools; this would permit us to draw the contrast between conventional and team teaching schools on a "before-after" basis. But what our informants told us were conventional schools, turned out upon measurement not to be so conventional after all--at least, not in the sense of conventionality portrayed in educational writings.

It is clear to me that we need to replace stereotypes of the school's work system with useful analytical categories. Careful description and measurement is one avenue to that goal.

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